

WHAT IS CLAIMED IS:

1. A method for delivering a medical device into the heart wall of a patient, comprising:

5 delivering a guidewire into the patient, the guidewire once delivered having a proximal end extending out of the patient and a distal end positioned adjacent the heart wall;

inserting the distal end of the guidewire into the heart wall;

anchoring the guidewire to the heart wall; and

10 advancing an introducer catheter carrying the medical device over the guidewire to deliver the device into the heart wall.

2. The method of Claim 1, wherein the guidewire is delivered percutaneously into the patient.

3. The method of Claim 2, wherein the distal end of the guidewire is advanced through a blockage in a coronary artery.

15 4. The method of Claim 2, wherein the distal end of the guidewire is advanced through a coronary vein.

5. The method of Claim 2, wherein the distal end of the guidewire is advanced into the left ventricle.

20 6. The method of Claim 1, further comprising advancing a delivery catheter into the patient prior to delivering the guidewire, the delivery catheter comprising a tubular body having a proximal end and a distal end and a lumen extending at least partially therethrough, until the distal end of the delivery catheter is positioned adjacent the heart wall.

25 7. The method of Claim 6, further comprising turning the distal end of the guidewire toward the heart wall prior to inserting the distal end of the guidewire, by:

actuating an anchoring member mounted on the distal end of the delivery catheter to secure the delivery catheter within the patient; and

30 actuating a steering member mounted on the distal end of the tubular body at a position distal to that of the anchoring member to turn the distal end of the delivery catheter toward the heart wall; and

advancing the guidewire through the lumen in the delivery catheter and out the distal end of the delivery catheter.

8. The method of Claim 1, wherein the guidewire is a tip-deflecting wire, and further comprising turning the distal end of the guidewire toward the heart wall prior to inserting the distal end of the guidewire by actuating the tip-deflecting wire.

9. The method of Claim 1, further comprising:

5 providing a passageway adjacent the heart wall having a proximal opening for receiving the distal end of the guidewire and a side port exit facing the heart wall;

wherein delivering the guidewire comprises advancing the distal end of the guidewire through the passageway toward the heart wall.

10 10. The method of Claim 9, wherein the passageway is provided through a lumen in a delivery catheter.

11. The method of Claim 9, wherein the passageway is provided through an anchoring member mounted to a distal end of a delivery catheter.

12. The method of Claim 1, wherein anchoring the guidewire to the heart wall comprises providing at least one barb attached to the distal end of the guidewire, the barb having a shape that facilitates advancement of the guidewire distally through the heart wall but prevents retraction of the guidewire proximally.

13. The method of Claim 1, wherein inserting the distal end of the guidewire into the heart wall comprises advancing the guidewire from a coronary blood vessel until the distal end extends into the left ventricle.

14. The method of Claim 1, wherein anchoring the guidewire further comprises expanding an anchoring member mounted on the distal end of the guidewire within the left ventricle.

15. The method of Claim 14, wherein the anchoring member is an inflatable balloon.

16. The method of Claim 1, wherein advancing the introducer catheter carrying a medical device further comprises:

pulling proximally on the guidewire anchored to the heart wall; and  
pushing the introducer catheter over the guidewire into the heart wall.

17. A method for delivering a conduit into a heart wall to bypass a blockage formed in a coronary artery, comprising:

creating a channel from a position proximal to the blockage in the coronary artery to a position distal to the blockage in the coronary artery;

advancing a guidewire through the channel until a distal end of the guidewire is adjacent the heart wall;

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inserting the guidewire into the heart wall; and

advancing a conduit over the guidewire into the heart wall.

18. The method of Claim 17, wherein the channel is a tunnel formed through the myocardium.

19. The method of Claim 17, wherein the conduit is a stent.

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20. A method for creating a bypass around a blockage in a blood vessel, comprising:

delivering a guidewire along a pathway from a location in the blood vessel proximal to the blockage to a location in the blood vessel distal to the blockage; and

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creating a channel along the pathway formed by the guidewire.

21. The method of Claim 20, wherein the blockage occurs in a coronary artery.

22. The method of Claim 21, wherein the guidewire is delivered through the heart wall.

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23. The method of Claim 22, wherein creating the channel comprises dilating the pathway formed by the guidewire.

24. The method of Claim 23, further comprising implanting a shunt in the dilated pathway.

25. The method of Claim 21, wherein the guidewire is delivered through the pericardial space, and further comprising providing a shunt over the guidewire.

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26. The method of Claim 20, wherein the guidewire has eyes for navigation.

27. A method for creating a bypass around a blockage in a coronary artery, adjacent a heart wall, comprising:

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inserting a needle into a patient into the heart wall, the needle having a lumen extending therethrough;

advancing the needle through the heart wall and into the coronary artery distal to the blockage;

advancing a guidewire through the lumen in the needle, the guidewire once advanced extending through the coronary artery proximal to the blockage, through the heart wall, and into the coronary artery distal to the blockage;

removing the needle from the patient while leaving the guidewire in place;

advancing a shunt over the guidewire, the shunt once advanced having a distal end in the coronary artery distal to the blockage.

28. The method of Claim 27, wherein prior to inserting the needle into the heart wall, the needle is inserted into the coronary artery from the pericardial space through the anterior wall of the coronary artery at a location proximal to the blockage.

29. The method of Claim 27, wherein the shunt once delivered has a proximal end in the coronary artery proximal to the blockage.

30. The method of Claim 27, wherein the needle is advanced through the heart wall into the left ventricle and back into the heart wall.

31. The method of Claim 30, wherein the shunt once delivered has a proximal end opening toward the left ventricle.

32. The method of Claim 27, wherein the needle is pre-shaped in a carved configuration.

33. A method for creating a bypass through the heart wall of a patient to bypass a blockage formed in a coronary artery, comprising:

creating a first tunnel through the heart wall having a proximal end and a distal end, the proximal end opening into the coronary artery proximal to the blockage, and the distal end positioned within the heart wall;

creating a second tunnel through the heart wall, the second tunnel having a first branch extending from the distal end of the first tunnel and opening into the coronary artery at a position distal to the blockage, and a second branch extending from the distal end of the first channel and opening into a heart chamber; and

disposing a conduit in the second tunnel to provide a passageway therethrough.

34. The method of Claim 33, wherein the conduit is a stent.

35. The method of Claim 33, further comprising closing off the first tunnel at the distal end thereof.

36. The method of Claim 33, further comprising closing off the first tunnel at the proximal end thereof.

37. A delivery catheter, comprising:

an elongate tubular body having a proximal end and a distal end and a lumen extending therethrough;

a first steering member mounted on the distal end of the tubular body; and

a second steering member mounted on the distal end of the tubular body at a position distal to that of the anchoring member.

38. The catheter of Claim 37, wherein the first steering member is an expandable anchoring member which, when actuated, is sized to press against a wall of the body lumen to secure the catheter within the lumen.

39. The catheter of Claim 38, wherein the second steering member is an expandable member which, when actuated, cooperates with a wall of the body lumen to turn the distal end of the catheter.

40. The catheter of Claim 39, wherein the second steering member is capable of turning the distal end of the catheter greater than 90 degrees.

41. The catheter of Claim 37, wherein the anchoring member and steering member are inflatable balloons.

42. The catheter of Claim 37, wherein the anchoring member is mounted to one side of the tubular body and the steering member is mounted to an opposite side of the tubular body.

43. A method for turning a distal end of a catheter within a body lumen, the catheter comprising an elongate tubular body having a proximal end and a distal end, the method comprising:

actuating an anchoring member mounted on the distal end of the tubular body to secure the catheter against the body lumen; and

actuating a steering member mounted on the distal end of the tubular body at a position distal to that of the anchoring member, wherein the steering member when actuated cooperates with the body lumen to turn the distal end of the catheter.

44. The method of Claim 43, wherein the anchoring member and the steering member are inflatable balloons.

45. A method for delivering a medical device to a delivery site within a patient comprising:

providing a delivery catheter having a proximal end and a distal end and a lumen extending therethrough into a body lumen of the patient;

5       securing the delivery catheter within the body lumen;

turning the distal end of the catheter by actuating a steering member mounted on the distal end of the catheter which pushes off against a wall of the body lumen; and

10       advancing the medical device through the lumen of the delivery catheter and out the distal end.

46. The method of Claim 45, wherein the steering member when actuated pushes off a wall of the body lumen to turn the distal end of the catheter.

47. The method of Claim 45, wherein securing the delivery catheter comprises actuating an anchoring member mounted on the distal end of the catheter against the wall of the body lumen.

15       48. The method of Claim 47, wherein actuating the anchoring member comprises inflating a balloon against the wall of the body lumen.

49. The method of Claim 45, wherein actuating the steering member comprises inflating a balloon against the wall of the body lumen.

20       50. A catheter, comprising:

an elongate tubular body having a proximal end and a distal end and a lumen extending at least partially therethrough; and

means for turning the distal end of the catheter mounted on the distal end of the tubular body.

25       51. The catheter of Claim 50, wherein the means for turning the distal end of the catheter includes means for anchoring the catheter to a body lumen.

52. A method for delivering a conduit into the heart wall of a patient, comprising:

30       advancing a delivery catheter into the vasculature of the patient, the delivery catheter having a proximal end and a distal end and a lumen extending therethrough, until the distal end is adjacent the heart wall;

actuating a pull wire extending from the distal end of the delivery catheter to turn the pull wire toward the heart wall;

advancing the pull wire from the distal end of the delivery catheter into the heart wall; and

5 delivering the conduit over the pull wire into the heart wall.

53. The method of Claim 52, wherein the conduit is a stent.

54. A method for delivering a conduit into the heart wall of a patient, comprising:

10 advancing a delivery catheter into the vasculature of the patient, the catheter having a proximal end and a distal end and a lumen extending from the proximal end to a side port near the distal end, until the side port faces the heart wall;

inserting a guidewire having a proximal end and a distal end into the lumen;

15 advancing the distal end of the guidewire through the lumen and out the side port;

advancing the guidewire into the heart wall; and

delivering the conduit over the guidewire into the heart wall.

20 55. The method of Claim 54, further comprising anchoring the delivery catheter within the vasculature.

56. The method of Claim 54, wherein anchoring of the delivery catheter comprises expanding an anchoring member mounted to the distal end of the delivery catheter.

25 57. The method of Claim 56, wherein the anchoring member is an inflatable balloon.

58. The method of Claim 56, further comprising perfusing blood through at least one channel in the anchoring member.

30 59. The method of Claim 54, wherein the distal end of the guidewire is advanced out the side port at an angle greater than about 90 degrees relative to the direction the guidewire is advanced through the lumen.

60. A method for delivering a conduit into the heart wall of a patient, comprising:

advancing a delivery catheter into the vasculature of a patient, the catheter having a proximal end and a distal end, until the distal end is adjacent the heart wall;

5       expanding an anchoring member mounted on the distal end of the catheter to secure the delivery catheter within the vasculature;

      inserting a guidewire having a proximal end and a distal end through a lumen in the expanded anchoring member, the lumen extending from a proximal end of the anchoring member to a side port facing the heart wall, so that the distal end of the guidewire exits through the side port;

10       advancing the guidewire into the heart wall; and

      advancing the conduit over the guidewire into the heart wall.

61.   The method of Claim 60, wherein expanding the anchoring member comprises inflating a balloon.

62.   The method of Claim 60, further comprising perfusing blood through at  
15   least one channel in the expanded anchoring member.

63.   A delivery catheter, comprising:

      an elongate body having a proximal end and a distal end;

      an expandable member mounted on the distal end of the tubular body, the expandable member having a proximal end and a distal end and an exterior  
20   surface; and

      a guide lumen extending from the proximal end of the expandable member to a side port on the exterior surface of the expandable member for directing a medical device therethrough.

64.   The delivery catheter of Claim 63, wherein the guide lumen extends  
25   through the elongate body from the side port to the proximal end of the elongate body.

65.   The delivery catheter of Claim 63, wherein the guide lumen is separate from the elongate body.

66.   The delivery catheter of Claim 63, wherein the guide lumen curves up to about 90 degrees.

30       67.   The delivery catheter of Claim 63, wherein the expandable member is an inflatable balloon.



68. The delivery catheter of Claim 63, further comprising a perfusion channel to allow blood to flow therethrough.

69. The delivery catheter of Claim 68, wherein the perfusion channel extends through the expandable member.

5 70. A delivery catheter, comprising:

an elongate body having a proximal end and a distal end defining a generally longitudinally axis therebetween;

a guidewire lumen extending at least partially between the proximal end and the distal end of the elongate body and having a proximal end and a distal end;

10 an exit port at the distal end of the guidewire lumen creating a curve of between about 0 and 180 degrees relative to the longitudinal axis of the elongate body for directing a guidewire out of the lumen.

71. The delivery catheter of Claim 70, wherein the exit port is a side port formed proximal to the distal end of the elongate body.

15 72. The delivery catheter of Claim 71, further comprising an expandable member mounted proximal to the side exit port.

73. The delivery catheter of Claim 71, further comprising an expandable member mounted distal to the side exit port.

20 74. The delivery catheter of Claim 70, wherein the guidewire lumen extends between the proximal end and the distal end of the elongate body, and the exit port is located at the distal end of the elongate body.

75. The delivery catheter of Claim 74, further comprising a narrowing passageway between the guidewire lumen and the exit port.

25 76. A catheter, comprising:  
an elongate tubular body having a proximal end and a distal end and a lumen extending at least partially therethrough;

means provided near the distal end of the tubular body for directing a guidewire at an angle into a body tissue.

30 77. A method for treating an aneurysm, comprising:  
advancing a catheter having a proximal end and a distal end to the site of the aneurysm;

actuating an expandable member mounted on the distal end of the catheter  
to substantially enclose the aneurysm; and  
inserting an embolic element into the aneurysm.

5        78. The method of Claim 77, wherein the embolic element is inserted  
through a lumen in the expandable member.

79. The method of Claim 77, wherein actuating the expandable member  
comprises inflating a balloon.

80. The method of Claim 77, further comprising perfusing blood through at  
least one channel in the expandable member.

10       81. The method of Claim 77, wherein the embolic element is a wire.

82. A method for treating an aneurysm, comprising:  
enclosing the aneurysm; and  
inserting an embolic element into the aneurysm while the aneurysm is  
closed.

15       83. The method of Claim 82, wherein the embolic element is inserted into  
the aneurysm by delivering wire through a catheter.

84. The method of Claim 82, wherein the aneurysm is enclosed with an  
inflatable balloon.

20       85. The method of Claim 84, wherein the embolic element is inserted into  
the aneurysm by delivering wire through the balloon.

86. An assembly for delivering a medical device into a heart wall of a  
patient, comprising:

an insertion tube having a proximal end and a distal end and a delivery  
channel extending therethrough;

25       a tubular member having a proximal end and a distal end and a lumen  
extending therethrough, the tubular member having a distal portion provided with  
an internal spring bias tending to form said distal portion into an arcuate  
configuration in the absence of an external straightening force on said distal  
portion, the tubular member being longitudinally slidable in said delivery channel,  
30       and wherein said distal portion may be alternately maintained in a relatively  
straightened configuration in the distal end of said channel and moved outside of  
said channel to assume said arcuate configuration; and

a guidewire longitudinally slidable within the lumen of the tubular member.

87. A method for delivering a guidewire at an angle into a desired insertion site in the body, the method comprising:

5 delivering an insertion tube into the vasculature of a patient, the insertion tube having a delivery channel extending therethrough and once delivered having a proximal end located outside of the patient and a distal end located adjacent a desired insertion site;

10 delivering a delivery catheter through the delivery channel, the delivery catheter having a guidewire lumen extending therethrough, the delivery catheter once delivered having a proximal end outside of the patient and a distal end within the delivery channel;

15 ejecting the distal end of the delivery catheter out of the delivery channel at the distal end of the insertion tube, the ejection of the delivery catheter from the delivery channel causing the distal end of the delivery catheter to turn toward the insertion site; and

advancing a guidewire through the guidewire lumen into the insertion site.

88. The method of Claim 87, wherein the delivery catheter comprises a tubular member having a distal portion provided with an internal spring bias tending to form said distal portion into an arcuate configuration in the absence of an external  
20 straightening force on said distal portion.

89. A method for delivering a guidewire into the heart wall, comprising:

25 inserting a guidewire into a lumen of a delivery catheter, the guidewire having a proximal section and a distal section, the distal section of the guidewire being folded back over the proximal section while inside the delivery catheter lumen;

delivering the delivery catheter into a patient, the delivery catheter once delivered having a proximal end outside of the patient and a distal end adjacent a desired insertion site in the heart wall;

30 ejecting the distal section of the guidewire out of the lumen of the delivery catheter at its distal end; and

pulling proximally on the guidewire such that the distal section punctures into the heart wall at an obtuse angle relative to the direction that the guidewire is ejected out of the lumen of the delivery catheter at its distal end.

5 90. The method of Claim 89, further comprising, prior to pulling proximally on the guidewire, turning the guidewire so that the distal section faces the heart wall.

91. A method for delivering a guidewire into an insertion site in the body, comprising:

10 advancing a delivery catheter having a proximal end and a distal end and a lumen extending therethrough into the body, the distal end of the delivery catheter once advanced being located adjacent the insertion site;

turning the distal end of the delivery catheter toward the insertion site; and

advancing a guidewire through the lumen in the delivery catheter from the proximal end toward the distal end; and

15 guiding the guidewire out the distal end and into the insertion site through a narrowing passageway formed in the lumen.

92. A medical guidewire, comprising:

an elongate body having a proximal end and a distal end; and

a tip on the distal end having a screw configuration.

20 93. A method for delivering a medical device into a body tissue of a patient comprising:

inserting a guidewire having a proximal end and a distal end into the heart wall from a coronary blood vessel;

anchoring the guidewire to the body tissue;

pushing the medical device over the guidewire into the body tissue; and

25 pulling on the proximal end of the guidewire while advancing the medical device through the body tissue.

94. The method of Claim 93, wherein anchoring the guidewire comprises actuating an expandable member.

30 95. The method of Claim 94, wherein the expandable member is an inflatable balloon.

96. The method of Claim 93, further comprising providing at least one barb on the distal end of the guidewire to anchor the guidewire to the heart wall.

97. A delivery system for directing a medical treatment at least partially into the heart wall, comprising:

a guidewire having a proximal end and a distal end;

means for turning the distal end of the guidewire toward the heart wall;

means for anchoring the guidewire to the heart wall; and

a catheter carrying the medical treatment having a lumen extending therethrough for receiving the guidewire and advancing the catheter into the heart wall.

98. A method for delivering a conduit into the heart wall of a patient to bypass a blockage formed in a coronary artery, comprising:

advancing a catheter having a proximal end and a distal end and a lumen extending at least partially therethrough from the proximal end to a distal opening through the coronary artery of the patient until the distal opening is past the blockage;

turning the catheter so that the distal opening faces the heart wall;

extending a wire having a proximal end and a distal end through the distal opening such that the distal end punctures into the heart wall;

anchoring the distal end of the wire to the heart wall;

delivering a dilation catheter over the wire, the catheter carrying a dilation balloon on a distal end thereof, until the balloon is within the heart wall;

inflating the dilation balloon to create an opening in the heart wall;

deflating the dilation balloon and removing the dilation catheter from the wire;

delivering a conduit introducer catheter over the wire, the conduit introducer catheter carrying a conduit on a distal end thereof, until the conduit is located within the opening in the heart wall, and

deploying the conduit within the opening in the heart wall.

99. The method of Claim 98, wherein the conduit is a stent.

100. A method for delivering medical treatment into the heart wall of a patient, comprising:

delivering a tubular wire having a lumen extending therethrough into the patient, the wire once delivered having a proximal end extending out of the patient and a distal end positioned adjacent the heart wall;

5 providing a means for turning the distal end of the wire towards the heart wall;

inserting the distal end of the wire into the heart wall; and

delivering the medical treatment through the lumen in the wire into the heart wall.

10 101. The method of Claim 100, wherein delivering medical treatment through the lumen comprises providing drug fluid into the lumen at the proximal end.

102. The method of Claim 100, wherein the distal end of the wire further comprises at least one exit port.

103. The method of Claim 100, wherein the means for turning the distal end comprises delivering the wire through a delivery catheter.

15 104. The method of Claim 103, wherein the means for turning the distal end further comprises:

actuating an anchoring member mounted on a distal end of the delivery catheter to secure the delivery catheter within the patient; and

20 actuating a steering member mounted on the distal end of the tubular body at a position distal to that of the anchoring member to turn the distal end of the delivery catheter toward the heart wall.

105. The method of Claim 100, wherein the tubular wire is a pull wire, and the means for turning the distal end comprises actuating the pull wire.

25 106. The method of Claim 100, wherein the means for turning the distal end comprises:

providing a curved passageway adjacent the heart wall having a proximal opening for receiving the distal end of the tubular wire and a side port exit facing the heart wall; and

delivering the tubular wire through the curved passageway.

30 107. The method of Claim 106, wherein the passageway is provided through a lumen in a delivery catheter.

108. The method of Claim 106, wherein the passageway is provided through an anchoring member mounted to a distal end of a delivery catheter.